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IS 1991-9 (1987): Safety requirements for the use, care and protection of abrasive grinding wheels, Part 9: General operating rules [PGD 9: Abrasives]

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Indian Standard

(Reaffirmed 2002)

SAFETY REQUIREMENTS FOR THE USE, CARE AND PROTECTION OF ABRASIVE GRINDING WHEELS

PART 9 GENERAL OPERATING RULES

(Second Revision)

Abrasives Sectional Committee, EDC 13; Grinding Wheels Subcommittee, EDC 13 : 1 [Ref : Doc : EDC 13 (4721)]

1. Scope — This standard (Part 9) covers the general operating rules with regard to abrasive grinding wheels.

2. Rules

2.1 *User's Responsibility* — Competent and trained persons shall be assigned to mounting, care, and inspection of abrasive wheels and grinding machines.

The abrasive wheel operator shall be fully instructed in the use, care and protection of abrasive wheels.

More efficient grinding and a reduction of wheel breakages will result when the user insists that only personnel with mechanical aptitude and a good knowledge of the contents of this standard be assigned to the mounting care, inspection and operation of abrasive wheels and grinding machines.

2.2 *Wheel Breakage* — Wheel breakage shall be investigated by the user to determine and correct the cause. In the event of a wheel breakage which causes personal injury, the wheel manufacturer and the machine builder should be notified immediately.

A cracked or damaged wheel shall not be used.

Should an abrasive wheel be broken in service an investigation must be made immediately by the user to be sure that any conditions at variance with the requirements contained in the standard are corrected.

The user should immediately isolate the machine and work area and notify the wheel-maker and machine-builder. Corrections of adverse conditions should only be made following a complete investigation and recommendation by all the parties concerned. This will help determine the cause of the breakage so that a recurrence of the trouble can be prevented.

2.2.1 *Inspection after breakage* — Whenever a wheel is broken, a careful inspection shall be made to make sure that the hood has not been damaged, nor the flanges bent, sprung out-of-tune or out-of-balance. The spindle and nuts shall also be carefully inspected.

Should a grinding wheel be broken in service, the cause of breakage should be immediately investigated and established. Such procedure will correct the condition and prevent a recurrence. The more important factors to be investigated at the time of a wheel breakage are:

a) Grinding wheel:
  1) Proper wheel selection; and
  2) Wheel inspection.
b) Machine equipment:
  1) Spindle speed;
  2) Mounting equipment, flange design and size and flange condition (if worn and sprung); and
  3) Adequacy of guards.
c) Wheel mounting procedure:
  1) Free fit on spindle,
  2) Clean washers used, and
  3) Flanges carefully tightened.
d) Evidence of accidental abuse:
  1) Dropped wheel or equipment,
  2) Damage from external sources, and
  3) Abusive pressure or other practice by operator.

A thorough investigation at the time of breakage will prevent future trouble.

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2.3 *Replacing Safety Guards* — At the completion of wheel mounting, the safety guard shall be in place and should be checked for condition and adjustment. All safety guard fasteners shall be in place and properly tightened (*see* Part 4 of this standard full information and exceptions).

2.4 *Wheel Speed* — It shall be determined at the time of mounting a wheel that spindle speed does not exceed the maximum operating speed marked on the wheel or wheel package. When a partly used wheel is remounted, spindle speed in revolutions per minute may exceed the maximum revolutions per minute marked on the wheel provided the maximum peripheral speed (metres per second) established for the wheel when new, is not exceeded.

On some variable speed machines the spindle speed is governed by an interlock with the guard or some other device that allows the rpm to be increased as wheel diameter decreases. Care must be exercised to determine that such devices are in good working order to prevent the possibility of over-speeding and wheel breakage.

Machine builders usually offer maintenance literature which can be useful in preventing wheel failure caused by overspeed conditions. Variable pitch pulleys require continual maintenance to remain in proper working order.

2.5 *Starting the Wheel* — All abrasive wheels shall be run at operating speed with safety guard in place or in a protected enclosure for at least one minute before applying work, during which time no one shall stand in front of or in line with the wheel.

This provision shall apply each time whenever one of the following conditions occurs:

a) A new wheel has been mounted,

b) A used wheel has been remounted.

An abrasive wheel may be damaged in shipment or storage or the wheel may be subjected to improper and excessive stresses during mounting. Wheels which have been damaged or are under excessive stress are likely to fracture within the first minute of rotation at operating speed.

While this procedure is most important at the time when an abrasive wheel is mounted or remounted, damage may also occur to a wheel during a shut down of the machine on which it is mounted. The user should evaluate the circumstances and the length of machine shut down to determine additional times that the operating rule should be followed.

2.5.1 It is most important that swing frame and portable grinding machines shall be switched off when actually not in use.

2.6 *Balance* — Out of balance wheels which set up vibrations can result in marred work surfaces, machine damage and also cause stresses which could contribute to wheel failure. Wheels which cannot be corrected for imbalance by the user shall not be used.

On precision grinding machines equipped with balance adjustment devices, wheel/spindle assemblies should be corrected for imbalance by utilizing such devices.

When a grinding machine has not build-in precision balance adjustment device, balance must be accomplished by other means. Usually this means dressing or truing the wheel as shown in Fig. 1 or with other devices such as diamond dressers.

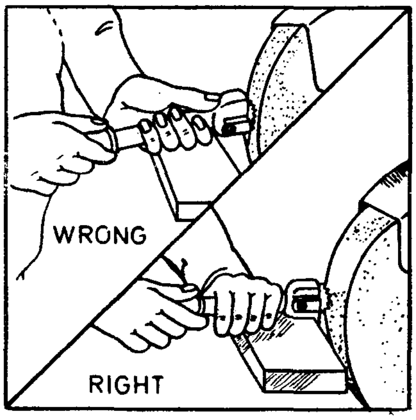

FIG. 1 METHOD OF DRESSING OF WHEEL

2.7 *Truing and Dressing* — Truing a wheel corrects the runout condition on the grinding surface of the wheel. Truing shall be done by a competent person.

Dressing a wheel alters the cutting action or shape of the grinding surface.

A wheel which cannot be trued should not be used.

A method of dressing wheel used in off-hand operation is shown in Fig. 1. Note that the dresser should be supported on a work rest and that the work rest should be adjusted away from the wheel so that the heel of the dresser may hook over the work rest and be guided by it as the dresser is moved evenly across the wheel face. 'Bumping' a wheel with a heavy casting or other object is dangerous and will not dress a wheel properly.

2.7.1 *Dresser guards* — Wheel dressers, excepting the diamond type, shall be equipped with guards over the tops of the cutters to protect the operator from flying pieces of broken cutters or wheel particles.

2.8 *Wet Grinding* — Wheels used in wet grinding shall not be allowed to stand partly immersed in the coolant. The soaked portion may throw the wheel dangerously out of balance.

When shutting down a wet grinding operation, the coolant shall first be shut off and the wheel allowed to run free until all the coolant has been removed.

For satisfactory operation, adherence to recommended practices of coolant manufacture is very important. Fig. 2 shows distortion in the work piece due to the heat being located in the area of contact between wheel and work. Proper application of coolant will help minimize those conditions.

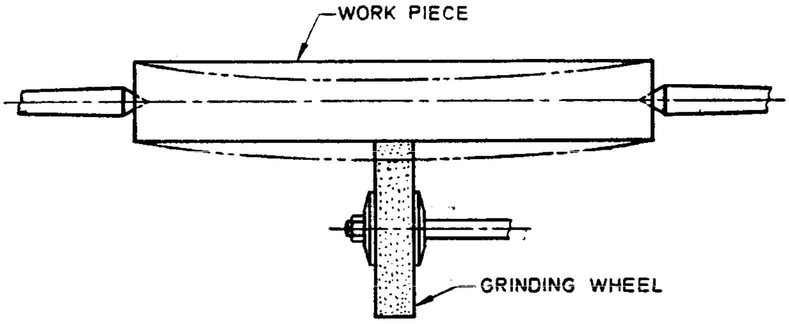

FIG. 2 DISTORTION IN WORK PIECE DUE TO HEAT IN AREA OF CONTACT

2.9 *Side Grinding* — Side grinding should only be performed with wheels designed for this purpose. Grinding on flat sides of the wheels designed for phripheral grinding may be dangerous may cause broken wheels. This does not preclude their use for applications such as shoulder and form grinding where it is recognized that a limited amount of side grinding is performed. Extreme caution should be exercised not to use excessive side pressure.

Peripheral grinding wheels should not be used for side grinding because of insufficient support to withstand the pressure exerted. Wheels designed for side grinding such as abrasive discs are mounted with one flat side against a suitable steel machine plate to safely withstand side pressure. Form grinding is not considered to be side grinding.

2.10 *Lubrication* — The machine spindle bearings shall be properly lubricated to prevent overheating or other conditions which might damage the abrasive wheel.

Improperly lubricated spindle bearings will cause the mounting spindle to expand because of heat generated, thus exerting a stress in the arbor hole area.

Other adverse conditions related to improper lubrication can cause vibrations which may result in a wheel being broken.

2.11 *Work Rests* — An offhand grinder shall be equipped with a work rest or other device which shall prevent the work piece from jamming between the abrasive wheel and the wheel guard.

The work rest or other device shall not contact the abrasive wheel at any time and shall be properly maintained as shown in Fig. 3.

When work rests are used, the following conditions shall be maintained at all times:

a) The work rest shall be adjusted such that the gap between the work rest and the grinding face of the abrasive wheel shall not exceed 3 mm,

b) The work rest height shall be on the horizontal centre line of the machine spindle.

c) The work rest shall not be adjusted while the abrasive wheel is rotating unless the work rest is designed to allow such adjustment.

d) The work rest shall be securely clamped after each adjustment.

When work rest cannot be used in accordance with (a) and (b) above, because of job requirements, the work rest can be adjusted, modified or eliminated to accommodate the operation. In that circumstance, the user shall provide a means for prohibiting the use of the grinder for other than the job for which the work rest was modified.

Jamming of the workpiece is a cause of wheel breakage and operator injury. Where work rests are not usable, such machines should be identified by warning signs, locked out when not in use or closely supervised as to use.

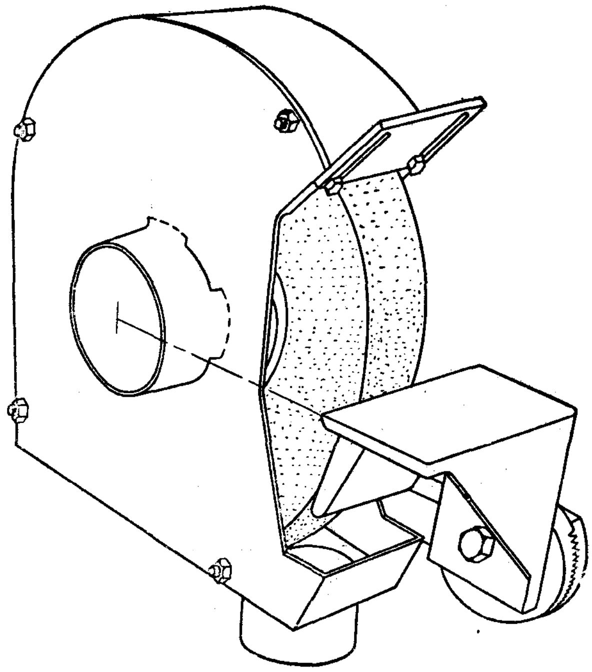

FIG. 3 FLOOR STAND GRINDER SHOWING ADJUSTMENT OF WORK REST TO WHEEL

2.12 *Maintenance*

2.12.1 *Grinding machine area* — The space about the machine shall be kept light, dry and as free as possible from obstructions.

2.12.2 *Machine maintenance* — An employer shall maintain grinding equipment in a condition which will not create a hazard for an employee. An employer shall instruct an employee to report defective equipment to an employee's supervisor.

Proper machine maintenance procedures are one of the most important aspects of safety in the use of abrasive wheels. Particular attention should be placed on those components or parts which can affect the speed of a wheel, such as governors on air grinders, variable pitch pulleys, gear boxes, and rheostats or other type of electrical controls.

2.12.3 *Check for wear* — All spindles, spigots or other machine parts on which wheels fit, shall be periodically inspected and maintained to size (Part 3 of this standard).

2.13 *Large Hole Inorganic Vitrified Bonded Wheels* — Large hole inorganic bonded wheels (those with hole in excess of one-fourth of the wheel diameter) should not be used on snagging operations.

Since the cross-sectional strength of an abrasive wheel decreases as its diameter approaches its hole size, it is not safe to use large hole inorganic wheels for snagging operations.

Large hole inorganic bonded wheels cannot be manufactured with retaining media such as steel rings.

2.14 *Wheel Discard Size* — The usable portion of an abrasive wheel shall be considered to be that portion which extends beyond the mounting flanges. A wheel shall not be worn down to a size which would allow the mounting flange assembly to contact the workpiece holding fixture.

Wheels which have been removed from one operation may be remounted as a smaller diameter wheel on another operation or machine, provided that proper mounting, speed and guarding regulations are observed.

2.15 *Eye Protection* — Suitable eye protection devices shall be provided and used by the operator for all grinding operations.

Most eye injuries could be prevented by the provision and use of suitable goggles or effective screens or better still, both. It is essential that appropriate eye protection for the particular work should be provided and used in all dry grinding and cutting-off operations, whether by fixed or portable machins, and for all materials on which such machins are employed. Screens of toughened glass are particularly useful on machines used for short periods by different operators who may be reluctant to wear goggles.

Easy adjustment of inclination of the screen window is ncessary to counter image reflection of external light sources from its surface.

To protect the lower surface of transparent glass screens from pitting by the stream of hot particles leaving the wheels, it should be covered with a thin sheet of suitably clear plastics material which will not pit as readily as glass and can be replaced quickly and cheaply. Dust should be excluded by binding together the edges of the glass and plastics with adhesive tape.

EXPLANATORY NOTE

The safe operation of abrasive wheels requires the understanding and cooperation of many diverse groups and of all individuals concerned with their use or operation. This has been the basic viewpoint in establishing these safety requirements for the guidance of manufacturers, users and others involved in handling these products.

A thorough knowledge of nature and characteristics of abrasive wheels, the grinding machines on which they are used and the safety and protection devices which can and shall be used to limit, if not eliminate, injury or damage in case of accidental wheel breakage, is necessary for proper understanding of these safety requirements. These safety requirements may be used as a guide and not as an alternative to constant educational programmes at all levels which are the best insurance against those unforeseen conditions or circumstances which result in an industrial accident.

The mandatory requirements are printed in normal (10 points) type and the explanatory information in smaller (8 point) type. This is intended to facilitate a condensed document of mandatory requirements together with supporting tables and a figure. The explanatory information gives the basic reasons for the rules to encourage their implementation in practice. However, it may not be termed as part of the standard. The explanatory material has been included to encourage compliance and it is given only where it amplifies or clarifies a requirement.

Operating rules are not included in these safety requirements unless they are of such a nature as to be important safety requirements equal in importance to other requirements included in this standard.

This standard was first issued in 1962 and its first revision was taken up in 1973, based on ANSI B 7.1-1970.

In order to review the individual section at any time and also for technical and drafting reasons alike, this standard has been split-up in the following ten parts:

Part 1 Scope and definitions
Part 2 Handling and storage
Part 3 General machine requirements
Part 4 Safety guards
Part 5 Flanges
Part 6 Inspection and mounting
Part 7 Standard speeds
Part 8 Special speeds
Part 9 General operating rules
Part 10 Mounted wheels

While splitting, this part (Part 9) of the standard has also been revised and the details have been made more explicit. More data has also been included.

While revising this standard, assistance has also been taken from the following publications:

> 'European safety requirement for the use, care and protection of abrasive wheels', issued by the Federation of European Producers of Abrasive Products (FEPA).
>
> ANSI B 7.1-1978 'Safety requirement for the use, care and protection of abrasive wheels', issued by the American National Standards Institute, USA.

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